

# A Q U A P H Y T E

A NEWSLETTER ABOUT AQUATIC, WETLAND AND INVASIVE PLANTS

## Center for Aquatic and Invasive Plants (CAIP)

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## At the Center

By William Haller, Acting Director

Certainly the highlight of the past 12 months at the Center for Aquatic and Invasive Plants (CAIP) was the arrival of Dr. Stephen Enloe to fill the Extension/Research faculty position in the area of natural areas and aquatic weed control. He is finishing some projects on cogongrass research that he initiated in his former position at Auburn University. He has undertaken the task of learning everything about Old World climbing fern, water primrose, Chinese tallow, and Brazilian pepper, among others. Read more about Dr. Enloe's work on page 3.

In addition to Dr. Enloe, we now have several new graduate students. Read more about them on page 14. Carl Della Torre completed his Master of Science degree working on *Rotala* with Dr. Lyn Gettys at the Fort Lauderdale Research and Education Center. He has now returned to the CAIP to work as a biologist for Drs. Netherland and Enloe.

The Florida Invasive Plant Trust Fund and management programs increased considerably in the 1970s–80s and state agencies played a significant and important role in aquatic plant management. Two key people retired in the past year: Jeff Schardt of the Florida Fish and Wildlife Conservation Commission and Dan Thayer of the South Florida Water Management District were both very supportive and provided guidance to CAIP research and education programs. Their contributions and collective experience will be sorely missed.

Dr. Joe Joyce previously worked with the US Army Corps of Engineers (Jacksonville District) in aquatic plant management and was the first full-time director of the Center for Aquatic and Invasive Plants, serving from 1982–1992. In 1992, he joined the UF/IFAS Administration until his retirement in November 2015. Dr. Joyce laid the groundwork for many CAIP research and extension programs on invasive weeds that will continue for many years. He developed great relationships and rapport with many state and federal agencies and other stakeholders and increased public education efforts of the CAIP Information Office, including our highly successful and popular website. Congratulations to Joe upon his retirement and we thank you for your vision, foresight and accomplishments.

Center and Institute of Food and Agricultural Sciences (IFAS) faculty often participate in activities outside of Florida. I was fortunate to have participated in a task force reviewing the invasive species program for the Canadian Province of Alberta in January 2015. The team consisted of several people from around North America who reviewed the rules, regulations and prevention programs of the Province and made recommendations for program improvements. Other international work by Center cooperative faculty includes Dr. Jim Cuda's 3-month sabbatical in southern Brazil. Dr. Cuda is an entomologist working in biological control of invasive plants (see page 15). In addition, Courtesy Associate Professor Dr. Michael Netherland (US Army Engineer Research and Development Center) recently completed a collaborative herbicide study in Ontario, Canada on water

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## Update from Michael Netherland

It is hard for me to believe, but I have been conducting research in the field of aquatic plant management for the past 28 years. I was able to spend the first 11 years at the US Army Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi; the next 5 years in private industry with the SePRO Corporation; and the last 12 years stationed at the University of Florida/IFAS Center for Aquatic and Invasive Plants (CAIP). I am very grateful to both ERDC and Dr. Haller for locating me at the UF CAIP. For this issue of Aquaphyte, Karen Brown asked me to give a short update on the status of my research. Successful collaborations provide the greatest satisfaction in research, and the ability to learn from and impart knowledge to others is critical in a small field like aquatic plant management. Given all of the recent (and coming) retirements, I sometimes wonder if we can maintain enough critical mass in the field of aquatic plant management research to remain relevant. Collaborations will allow us to remain both relevant and productive.

I must first mention the key funding and logistical support from ERDC that allows me to be a part of the UF CAIP. Dr. Linda Nelson and Dr. Al Cofrancesco manage and direct the Aquatic Plant Control Research Program (APCRP), and this program provides the key support for all my efforts. I maintain continued close contact with my team leader, Dr. Kurt Getsinger, on technical matters and issues that affect the field of aquatic plant management.

We have conducted multiple projects within the state of Florida and some history is in order here. Upon returning to the UF CAIP in 2003, discussions with Jeff Schardt of the Florida Fish and Wildlife Conservation Commission (FWC), Invasive Plant Management Section (IPMS) became integral in setting the course for my program in Florida. Jeff recommended that I hire a full-time biologist to assist with monitoring multiple field projects. This ultimately led to Dr. Haller and I bringing on Dean Jones as a full-time biologist stationed in Central Florida. Dean has been a huge asset to the UF CAIP and to the FWC. Jeff's key insight was that we often did not do a good job of monitoring short and long-term outcomes of large-scale and novel management projects, and therefore results often led to anecdotal observations. Dedicating a person to work directly with the FWC Regional Biologists to monitor operational treatments has greatly improved our understanding of herbicide efficacy, longevity, and selectivity. From large-scale hydrilla control to development of new approaches in managing floating plants, to improved native plant monitoring and mapping techniques, we have generated data that will be of value for years to come. Jeff retired in May, and he was replaced by Matt Phillips. While Matt and Jeff certainly have different styles, Matt is continuing to work with our group to address key issues faced by the IPMS. An example of

this collaboration is determining factors linked to reduction of native Kissimmee grass (*Paspalidium geminatum*) on the Kissimmee Chain of Lakes. While there are several theories on what may be causing the decrease in frequency and abundance, there is a strong need for collection of data to help address basal causes for this decline.

While I am stationed in Florida, I continue to conduct collaborative work throughout the country. Key efforts include 1) a large-scale demonstration project for control of monoecious hydrilla in the Erie Canal, NY. We are entering the third year of this demonstration, and the cooperation among the ERDC, the COE Buffalo District, NY DEC, and US Fish and Wildlife Service has been outstanding. Through intense management and sampling efforts we continue to learn more about the biology and phenology of this biotype of hydrilla as it spreads into the northern regions of the country; 2) We are also entering the third year of a partnership with Dr. Brenda Grewell of the USDA ARS in Davis, CA to study the biology and ecology of creeping water primroses (*Ludwigia* spp.). *Ludwigia* is rapidly expanding in several Western states as well as in Florida. Watching this plant spread in key aquatic systems in Florida has been alarming, and to date, we don't have a good handle on best management practices for *Ludwigia*. My colleague, Dr. Stephen Enloe, at the UF CAIP is also conducting research on this South American invader, and we need all the good minds we can muster to address this emerging problem; 3) Over the past several years, we have also focused on Eurasian and hybrid watermilfoils in Wisconsin and Minnesota. We just wrapped up a multi-year cooperative agreement with the Wisconsin Department of Natural Resources (DNR) and we are in the last year of a cooperative agreement with the Minnesota DNR. This work has provided several new insights into impacts of large-scale management on both target and native plants. As part of this effort, we analyzed thousands of water samples for herbicides to improve our knowledge of herbicide behavior following multiple management strategies. The funding and support of the WI DNR and MN DNR (via Chip Welling) is appreciated and this work greatly improved our knowledge of products that have been used for the past several decades; 4) we recently completed a collaboration with the Ontario Ministry of Natural Resources (OMNR). We conducted several mesocosm trials on water soldier (*Stratiotes aloides*) to demonstrate herbicide efficacy to support an eradication project for this plant on the Trent River. Under the guidance of Francine MacDonald and Holly Simpson (OMNR), the project has now gone operational and the dedication of the Canadians to this project has been admirable; 5) Dr. Rob Richardson (NCSU) and I were invited to Victoria, Australia (Dr. Tony Dugdale and Daniel Clement) in April to discuss improved methods for

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## Meet Stephen Enloe

Greetings from Gainesville! This has been a great year and I am very happy to be in Florida. First and foremost, I want to thank Drs. Ken Langeland (now Professor Emeritus), Bill Haller, and Mike Netherland for their incredible support in my transition to UF. I do fully recognize that I have some big shoes to fill with Ken's departure. During the past year, his sage advice to me has included such tidbits as the following:

- Regarding the job: "Don't screw it up!"
- Regarding addressing the Old World climbing fern in south Florida: "Better you than me! Good thing it is now your responsibility!"

Jokes aside, Ken has been very helpful as I have waded out into the world of aquatic weed control and I cannot thank him enough.

On a personal note, my wife and I welcomed the newest addition to our family: Gabriel Robert Enloe, born August 21, 2015. He is happy and healthy but I can say that this fall, sleep has not been plentiful! His birth coincided with my oldest son starting kindergarten, and my wife starting to teach her first class at UF. Needless to say, we have been busy!

As I wrap up my first year at the UF/IFAS Center for Aquatic and Invasive Plants, I would like to provide an overview of my program. In coming to Florida, my goal was to begin a program that would be responsive to the immediate needs of aquatic and upland invasive plant managers in the state. While the list of problems is long, here are some of the key projects I have taken on.

The first is creeping water primrose (*Ludwigia hexapetala*), which has become a real menace to a large number of water bodies in Florida (see photo on back cover). The aggressive growth habit of this plant, coupled with difficulties in accurate identification and effective control, has made it a top priority. Working with Dr. Colette Jacono, we are examining morphological and genetic variation of several populations from lakes around the state including Alligator, Butler, Harney, Poinsette, Toho, Monroe and more. I have also a graduate student, Afsari Banu, beginning growth studies and herbicide dose response studies across populations to better understand what our best management options are. I am very grateful to the Florida Fish and Wildlife Conservation Commission (FWC) for funding this work.

The second project I am working on is invasive grass control with selective graminicides (grass-specific herbicides). In 2015 Florida received an experimental use permit (EUP) to test sethoxydim as an aquatic herbicide for invasive grasses such as torpedograss (*Panicum repens*), West Indian marsh grass (*Hymenachne amplexicaulis*), para grass (*Urochloa mutica*), and others. We have established multiple studies in Ona, Okeechobee, and Gainesville,

Florida, to begin to compare the effectiveness of sethoxydim to glyphosate and imazapyr. Initial results are showing good selectivity and some promising efficacy. This is a tool that has been lacking for aquatic invasive grasses for years and our goal is to determine if it will be useful to meet invasive grass management goals. I am very grateful to the Army Corp of Engineers for supporting this project.

The third project involves finding selective options for Brazilian peppertree (*Schinus terebinthifolius*) control in mangroves. Mangroves are keystone species of our southern coastal areas, many of which are experiencing unprecedented invasion by peppertree. Mangroves are also highly sensitive to triclopyr, which is widely used for peppertree control. In a multi-step project, my second graduate student, Cody Lastinger, is literally throwing "everything but the kitchen sink" at peppertree to see if any of our newer aquatic herbicides have any peppertree potential. If so, we will then examine the response of our native black, red, and white mangroves and buttonwood tree to all promising treatments to assess selectivity. We hope to find options and begin field trials by late summer 2016. Again, I am very grateful to FWC for funding this work.

A fourth project I am now completing is an assessment of the "state of the state" of Old World climbing fern (*Lygodium microphyllum*) in Florida. It has been almost 10 years since the Lygodium Task Force developed the Lygodium Management Plan and there is considerable interest in our progress. I am currently summarizing all published research since 2006 and have also interviewed dozens of individuals from federal, state, and local land-management agencies across Florida. My goal is to update the Lygodium Management Plan and provide a clear picture of the good, the bad, and the ugly of what has been accomplished since 2006. Many thanks to the South Florida Water Management District for supporting this work.

Additionally, there are about a dozen other projects that I am moving forward with that I will be reporting on in 2016 including work on tallotree (*Triadica sebifera*), tung oil tree (*Aleurites fordii*), bishopwood (*Bischofia javanica*), coral ardisia (*Ardisia crenata*), shoebutton ardisia (*Ardisia elliptica*), and more.

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## Ten years already? Looking back, moving forward

### An update from the Florida Invasive Plant Education Initiative

By Katie Walters, Coordinator, Education Initiative

The Florida Invasive Plant Education Initiative began in 2006 and through the efforts of many—especially Vic Ramey and Amy Richard from UF/IFAS Center for Aquatic and Invasive Plants (CAIP) and Jeff Schardt from the Florida Fish and Wildlife Conservation Commission (FWC)—the program has been able to offer top-notch workshops, lesson plans, and educational resources for teachers throughout the state. A 10-year assessment was developed this year and sent to all teacher graduates of our workshops. Our goal was to assess whether teachers are still utilizing our materials, still teaching about the subject of invasive plants, and still remember what they learned about invasive plants and their management. Although we are still gathering responses, initial results are positive. The majority of respondents indicated they currently favor or strongly favor the use of herbicides (64%), the use of biological control agents (84%), the use of physical control methods (86%), and the use of mechanical harvesting (75%) to control invasive species. The majority of respondents also indicated they used specific materials from the Education Initiative with their students (average of 66%) and 90% said they would apply for a Plant Camp 2, if offered. We are in the process of compiling a complete report on this assessment.

### Plant Camp 2015 Report

Thanks to our sponsors, presenters and teacher participants, another successful Plant Camp was held from June 15<sup>th</sup>–19<sup>th</sup>, 2015. Teachers from across the state traveled to Gainesville for this truly unique hands-on learning experience. Presenters from UF/IFAS CAIP and affiliated departments, state agencies, and the private sector provided direction and information throughout the week. This was the 10th such workshop put on by the joint efforts of UF/IFAS CAIP and FWC. A lot has changed between Year 1 and Year 10, but our focus has always been to create an interactive learning experience on the topic of invasive plants and their management. After the workshop, teachers are provided with lesson plans, materials, and continuing support to introduce this important topic in their classrooms.

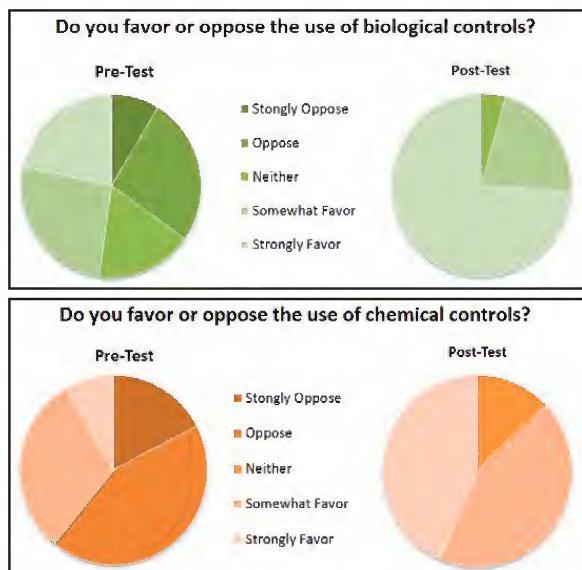
Each year, teachers are given a pre- and post-test and survey to determine attitude changes and knowledge gains. This year, our pre- and post-test and survey were updated to better reflect our learning objectives by working with Dr. Katie Stofer from UF/IFAS Department of Agricultural Education and Communication. Eleven knowledge-based questions and 4 opinion-based questions were asked. The overall knowledge increase was 14%, but individual questions showed knowledge increases ranged from 0 to 114%.

The survey asked the teachers' opinion on methods of invasive plant management: chemical, mechanical, biological,



Plant Camp teacher participants competed to remove the most tuberous sword fern. Here, the winners proudly pose with their cleared lot.

and physical. Two pie charts show the difference in survey responses from the pre- and post-test for the question, "Please indicate whether you favor or oppose the use of the following methods for invasive plant control." The darker colors on the chart indicate opposition to the method, the lighter colors indicate favoring the method. Plant Camp gives participants a behind-the-scenes look at the science, research, and application of invasive plant management strategies.



As you can see, for both biological and chemical control, many participants' opinions changed from pre- to post-test to favor both types of control methods. Teachers' written responses expand on their changing opinions: "I am so glad I had the opportunity to learn about all the different herbicides used for plant control. It really cleared up a lot of misconceptions."

Participants were also asked to rate their opinions on the importance of teaching about invasive species, their plans to implement Plant Camp curriculum, and any obstacles to implementation. Of the 22 teachers who completed a post-survey, 21 felt “prepared to implement the lessons learned at Plant Camp” and 1 felt “maybe” prepared. The 3 most common teacher needs were “More time to revise current curriculum to include what I learned at Plant Camp,” “More flexibility in my curriculum,” and “More money for supplies.” The Education Initiative continues to support these teachers once Plant Camp is over, with free materials available on loan and by developing class-specific lesson plans.



*Sara Zeleneki, David Porter and Patti Shultz learn about how hydrilla spreads while playing the Education Initiative's Hydrilla Game.*

One way we continue to support Plant Camp teachers is by visiting their classrooms and implementing lessons on invasive species with their students. For the past 4 years we have received funding through FWC to visit 10 classrooms each year. We visit classrooms across the state to implement Lakeville—A Natural Resource Management Activity. Each class gets to spend two days with CAIP staff learning about the various organisms and stakeholders in freshwater ecosystems—including how social, political, and environmental concerns all must be considered in order to make management decisions. Students take pre- and post-tests to measure knowledge gains. Last semester we saw an average gain of 22%, with individual questions ranging from 1% to 76% gain.

### **NEW! DBQ Lesson Plans**

Thanks to a donation from the Florida Aquatic Plant Management Society and FWC's continued support, we were able to work with a Plant Camp graduate and volunteer to develop 6 new activities featuring document-based-questions (DBQs). DBQs are short-answer or essay questions that require students to integrate their own knowledge with support from other sources. These activities align with the Florida Standards for English Language Arts. Our reading activities on aquatic plants and invasive plant management were

updated to reflect state technical reading standards. We were also able to adapt our popular audio-visual presentations for use in lower elementary by simplifying the associated guiding questions. All of these new lesson plans will be available for free from our website next semester!

### **Coming soon—for students only**

The Education Initiatives' website is in the process of a major overhaul, as are all of CAIP's sites. Currently, our site is focused on providing information and materials to educators. We are excited to unveil a student section on our site. The student section will include many audio-visual resources—introducing students to the identification, research, and management of invasive species. It will also contain science project ideas and a list of scientifically reputable websites to aid in research.

### **Continuing to spread beyond Florida**

Last year we provided an update on efforts to spread our invasive plant curriculum outside of Florida. After successfully training teachers from the Carolinas and providing them with a regionally-specific Lakeville Unit, we decided to try again, this time with Alabama teachers. Through the sponsorship of the Tennessee Valley Authority (TVA) and Mid-South APMS, we were able to have 2 Alabama teachers join us for Plant Camp. A few months later, we sent them their own region-specific Lakeville Unit. Alabama implemented their first Plant Camp teacher workshop this year, and plans on continuing to expand it using the Florida model. South Carolina plans to implement their first Plant Camp in Summer 2016. To help provide context for region-specific invasive species curricula, we are currently seeking funding to develop our popular audio-visual presentation Silent Invaders for a national audience. The presentation introduces viewers to the concept of native, non-native, and invasive; the problems invasive plants can cause; and what students can do to help prevent their spread. (You can view the Florida-based version on our website at [plants.ifas.ufl.edu/education/curriculum](http://plants.ifas.ufl.edu/education/curriculum))

### **Meet our newest team member**

The Education Initiative welcomes our new staff member, Italo Lenta. Italo works on creating and updating our lessons and activities as well as presenting them to both students and educators. He holds two Master of Science degrees from the University of Florida in Interdisciplinary Ecology and Soil & Water Sciences. Italo enjoys meaningful, values-driven work and is passionate about environmental protection and education. We are happy to have him on board!



The CAIP Invasive Plant Education Team:  
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## Aquatic Activities at the UF/IFAS Fort Lauderdale Research and Education Center

By Lyn A. Gettys, Assistant Professor of Agronomy

The University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS) has an active aquatics program in south Florida. The Fort Lauderdale Research & Education Center (FLREC) is situated within a tropical climate that enables us to do aquatic plant research year-round and we are finishing up our fourth full year of research. Carl Della Torre III, the first graduate student in the aquatics program at FLREC, completed his degree in August 2015 and has moved on to greener pastures. Samantha Sardes started her graduate program just as Carl finished his; she will be evaluating the effects of integrated insect and plant pest management on non-target organisms and many, many other topics. Biologist Kyle Thayer continues to run the day-to-day operations of the FLREC aquatics program and Ian Markovich is Kyle's invaluable second-in-command. We have a number of research projects that focus on the biology and control of aquatic invasive species, while other projects aim to provide guidance for restoration managers. Following is a sampling of these projects.

### Reproductive biology of crested floating heart (*Nymphoides cristata*)

The goal of these studies is to investigate how substrate composition and fertility affect production of ramets by crested floating heart, one of Florida's newest prohibited aquatic plants. We are also studying seed production and the influence of desiccation and burial depth on ramet sprouting in this floating-leaved aquatic weed. We began this research last year and will collect our final data in a few weeks.

### Integrated pest management for control of waterhyacinth (*Eichhornia crassipes*)

In 2013 and 2014 we evaluated the effects of combining the herbicide 2,4-D with three biological control insects: the long-established weevils *Neochetina eichhorniae* and *N. bruchi* and the newly introduced leaf-hopper *Megamelus scutellaris*. This research revealed synergy between the control methods, and we are now taking this research to the field for ground-truthing trials. As always, we are conducting these studies in cooperation with Drs. Phil Tipping and Carey Minter at the U.S. Department of Agriculture Invasive Plants Research Laboratory in Davie, Florida.

### Biology and control of rotala (*Rotala rotundifolia*)

Research conducted by Carl Della Torre III, a former graduate student at the FLREC, identified several aquatic

herbicides that could have utility in controlling this weed, which is thought to have invaded our waters via water garden and aquarium escapes. We are establishing field trials in southern Florida canals to determine whether our greenhouse results are replicated in the field.

### Evaluation of ecotypes of giant bulrush (*Schoenoplectus californicus*)

Our goal in this research is to identify differences in preferred growing conditions of ecotypes of giant bulrush, a valuable emergent plant used extensively in aquatic and wetland restoration. Six ecotypes (populations of plants collected from a particular ecosystem) are being evaluated under common nursery conditions to determine whether culture conditions (i.e., substrate type, nutrient level and water depth) have different impacts on the growth and establishment of these geographically isolated ecotypes.

### Field establishment of giant bulrush

We are also studying the effects of propagule size and source, planting density and seasonality on field establishment of giant bulrush. This multi-agency restoration research project is being conducted at the Orlando Wetlands Park in Christmas (about 10 miles west of Titusville), in cooperation with the Florida Fish and Wildlife Conservation Commission's Aquatic Habitat Restoration and Enhancement Subsection and the City of Orlando.

### Springs restoration research

We continued to provide plant material, guidance and expertise to projects focused on the restoration of springs near Crystal River, Florida.

**Upcoming events** include the Annual UF/IFAS FLREC Open House (January 23 in Davie), a 1.5-day aquatics session at the Florida Mosquito Control Association's Dodd Short Course (January 27–28 in Altamonte Springs), the Florida Weed Science Society annual meeting (February 29 and March 1 in Haines City), the International Conference on Aquatic Invasive Species (April 14–17 in Manitoba) and the annual UF/IFAS Aquatic Weed Control Short Course (May 2–5 in Coral Springs).

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*At the Center, continued from page 1*

soldier (*Stratiotes aloides*). He also was invited to Victoria, Australia, as part of a team to discuss improved aquatic plant control methods in irrigation canals (see page 2).

Preparation for major CAIP annual activities is in progress. The 40th Aquatic Weed Control Short Course, held annually by IFAS since 1976, will be held in Coral Springs, Florida, May 2–5, 2016. This 2.5-day training course provides research updates to more than 400 attendees and offers Continuing Educational Units (CEUs) for certified pesticide applicators and training for those taking the state pesticide certification exams. For more information, go to [www.conference.ifas.ufl.edu/aw](http://www.conference.ifas.ufl.edu/aw). In June, the CAIP/FWC Invasive Plant Education Initiative program (with other financial support) will have its 11th annual Plant Camp for teachers. This 4-day event will provide training to secondary school science teachers on incorporating approved curricula on invasive plants into their classrooms. The class includes hand-on field trips and classroom sessions. Read more on page 4.

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*Update from Michael Netherland, continued from page 2*

controlling aquatic plants in irrigation canals. We greatly enjoyed these interactions, and were also able to meet with colleagues from New Zealand (Dr. Paul Champion, Dr. Deborah Hofstrah, and Dr. John Clayton) to discuss their approaches to early detection and rapid response. These interactions were invaluable to expanding my thinking about aquatic plant management strategies; 6) Lastly, we continue to interact with the Aquatic Ecosystem Restoration Foundation (AERF) and work with industry members to conduct research throughout the country on novel herbicides and concepts to improve our ability to selectively control invasive plants.

In terms of day-to-day activities at the UF CAIP, I hired Carl Della Torre, who recently completed his M.S. with Dr. Lyn Gettys in South Florida. Carl is assisting Dr. Enloe, Dr. Haller, and me with various mesocosm and field projects. We also brought on Jens Beets from Washington. While Jens is currently assisting with multiple studies, he will start as a graduate student at the CAIP in Fall 2016. Lastly, Joshua Wood is a graduate student working on a master's project on the biology and management of monoecious hydrilla.

I look forward to continuing collaborative research efforts with colleagues who share a passion for the field of aquatic plant management.

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## Upcoming Meetings

**January 12-14, 2016**

**Northeast Aquatic Plant Management Society**  
Saratoga Springs, NY  
[www.neapms.net/](http://www.neapms.net/)

**February 8-11, 2016**

**Weed Science Society of America**  
San Juan, Puerto Rico  
<http://wssa.net>

**March 6-9, 2016**

**Midwest Aquatic Plant Management Society**  
Grand Rapids, MI  
[www.mapms.org/](http://www.mapms.org/)

**March 9-11, 2016**

**Florida Exotic Pest Plant Council Symposium**  
Melbourne, FL  
<http://www.fleppc.org/>

**March 20-23, 2016**

**Western Aquatic Plant Management Society**  
Del Mar, CA  
[wapms.org/](http://www.wapms.org/)

**May 2-5, 2016**

**UF/IFAS Aquatic Weed Short Course**  
Coral Springs, FL  
[www.conference.ifas.ufl.edu/aw/](http://www.conference.ifas.ufl.edu/aw/)

**June 7-10, 2016**

**Florida Lake Management Association Annual Symposium**  
Daytona Beach Shores, FL  
<http://flms.net/>

**July 16-20, 2016**

**Aquatic Plant Management Society**  
Grand Rapids, MI  
[apms.org/](http://apms.org/)

**October 17-20, 2016**

**Florida Aquatic Plant Management Society**  
Daytona Beach, FL  
[www.fapms.org/](http://www.fapms.org/)

## MARY'S PICKS

Items of special interest from APIRS Reader/Cataloger, Mary Langeland (retired)

**Campbell, S.H., Rybicki, N.B., & Schenk, E.R. 2015. The Distribution of Submersed Aquatic Vegetation and Water Lettuce in the Fresh and Oligohaline Tidal Potomac River, 2007 [U.S. Geological Survey, Open-File Report 2014-1259]; 33 pp.**

Surveys documenting the composition of species of submersed aquatic vegetation (SAV) have been conducted in the Potomac River for decades. These surveys can help managers assess the proportion of native and exotic plants in the river or can be used to determine relationships between native and exotic plants, environmental conditions, and wildlife. SAV coverage increased from 2005 to 2007 throughout the fresh and oligohaline study area. The 2007 survey documented here determined that eleven species of SAV were present. The abundance of the exotic species *Hydrilla verticillata* (hydrilla) was relatively low, and species diversity was relatively high compared to previous years. The survey also revealed a new population of the invasive, floating aquatic plant, *Pistia stratiotes* (water lettuce). In 2007, water lettuce, the latest exotic aquatic plant to be found in the fresh to oligohaline portion of the Potomac River, was most abundant in Mattawoman Creek, Charles County, Maryland. However, it was not observed in the fresh to oligohaline portion of the Potomac River in the summer of 2008. An understanding of the distribution of SAV species and factors governing the abundance of native and invasive aquatic species is enhanced by long-term surveys. (*Excerpt from report.*) <http://dx.doi.org/10.3133/ofr20141259>

**Gomez, B., Daviero-Gomez, V., Coffard, C., Martín-Closas, C. & Dilcher, D.L. 2015. *Montsechia*, an Ancient Aquatic Angiosperm. Pnas 112(35):10985-10988.**

The importance of very early aquatic flowering plants is not well understood currently and is poorly documented. Here the authors present details of the morphology and reproductive biology of *Montsechia*, an extremely early fossil angiosperm that, because it is so ancient and is totally aquatic, raises questions centered on the very early evolutionary history of flowering plants. This paper challenges the paradigm of how we view the early evolution of basal angiosperms and particularly the role of aquatic habitats in the very early evolution and diversification of flowering plants.

The early diversification of angiosperms in diverse ecological niches is poorly understood. Some have proposed an origin in a darkened forest habitat and others an open aquatic or near aquatic habitat. The research presented in the article by Gomez, et al. centers on *Montsechia vidalii*, first recovered from lithographic limestone deposits in the Pyrenees of Spain more than 100 years ago. This fossil material has been poorly understood and misinterpreted in the past. Now, based upon the study of more than 1,000 carefully prepared specimens, a detailed analysis of *Montsechia* is presented. The morphology and anatomy of the plant, including aspects of its reproduction, suggest that *Montsechia* is sister to *Ceratophyllum* (whenever cladistic analyses are made with or without a backbone). *Montsechia* was an aquatic angiosperm living and reproducing below the surface of the water, similar to *Ceratophyllum*. *Montsechia* is Barremian in age, raising

questions about the very early divergence of the *Ceratophyllum* clade compared with its position as sister to eudicots in many cladistic analyses. Lower Cretaceous aquatic angiosperms, such as *Archaeofructus* and *Montsechia*, open the possibility that aquatic plants were locally common at a very early stage of angiosperm evolution and that aquatic habitats may have played a major role in the diversification of some early angiosperm lineages. (*Excerpts from the article.*)

<http://www.pnas.org/content/112/35/10985.full.pdf+html>

**Small, J.K. 1927. Among Floral Aborigines: A Record of Exploration in Florida in the Winter of 1922. Journal of The New York Botanical Garden 28(325):1-20 (January 1927).**

John Kunkel Small (1892-1938) lived at a time before foundation or government supported research. His excursions to Florida were under the patronage of Charles Deering and later Arthur C. James. These were lively events, conducted by boat and car. Dr. Small often brought along his wife and children.

Small was the first to explore Florida since A. W. Chapman and many of the areas he documented had never been examined. His doctoral dissertation, published as *Flora of the Southeastern United States* in 1903, rev. 1913 and 1933, remains the best floristic reference for much of the south. His first trip to Florida was in 1901 when Miami had only about 2000 residents. The Florida hammock in which he was particularly interested had disappeared to such an extent by 1929 that he published *From Eden to Sahara: Florida's Tragedy*, sparking a movement for conservation of the wetlands that eventually resulted in the formation of Everglades National Park. (*Excerpts above are from Archives of the LuEsther T. Mertz Library, The New York Botanical Garden online Biography of John Kunkel Small, http://www.nybg.org/library/*)

The 1927 *Journal of the New York Botanical Garden* article by Small recounts the floristics and economic plants of Florida he encountered in a journey that took him the length and breadth of Florida in December of 1922. His trek ran along the eastern coast from the mouth of the Miami River to the mouth of the St. Johns River, over to the west coast to Crystal River, and, then, southward to Clearwater and inland to "the backbone of the lake region," ending at Lake Okeechobee. He describes and names the plants growing in "coastwise lagoons," prairies, marshes, and hydric hammocks as well as a range of upland habitats from scrub sandhills to shell mounds and kitchen middens of the pre-Columbian inhabitants.

(*Excerpts of interesting passages from Among Floral Aborigines: A Record of Exploration in Florida in the Winter of 1922 by J.K. Small*)

The earlier beginnings of economic botany, so to speak, in Florida are prehistoric. The historic records are coincident with the discovery of the peninsula by Ponce de Leon in 1513, but economic botany had long been an important, even a vital, factor in the life and occupations of the aborigines. In the early Spanish records of the conquest of Florida we meet with much concerning the uses of plants for foods and fibers, as the quotations will show:

"As Ponz (*sic*) de Leon passed along the eastern coast of Florida,



he inquired the name of the country; . . . in the end they answered his importunities by telling him that it was called Cautio – a name that was given to it by the Lucayans, because the inhabitants covered somewhat of their persons with plaited palmleaves." – Herrera.

"The inhabitants make bread of roots, which is their common food the greater part of the years; and because of the lake, which rises in some seasons so high that the roots cannot be reached in consequence of the water, they are for some time without eating this bread. . . . There is another root like the truffle of this country which is sweet." – Fontaneda.

Thus we find cycads (*Zamia*), palms (*Thrinax*, *Coccothrinax*, *Sabal*, *Serenoa*, *Paurotis*, *Rhapidophyllum*, *Roystonea*), Florida-moss (*Dendropogon*), green-brier (*Smilax*), ground-nut (*Glycine*), cassena (*Ilex*), and tunas or prickly-pears (*Opuntia*) mentioned more or less definitely, and also "fruits of different kinds which to mention would be endless." These records are intensely interesting, even fascinating, in the light of our recent botanical explorations in Florida and our studies in the very groups of plants so extensively used by the aborigines. (p.1-2)

The sand embankments of the aboriginal rectangular fortification which is situated between four and five miles north of West Palm Beach, originally extending from near the lagoon – LakeWorth – back into the scrub, are fast disappearing. Unfortunately, a settlement has been established in it, and thus the most interesting aboriginal monuments of Florida are becoming things of the past. (p.4)

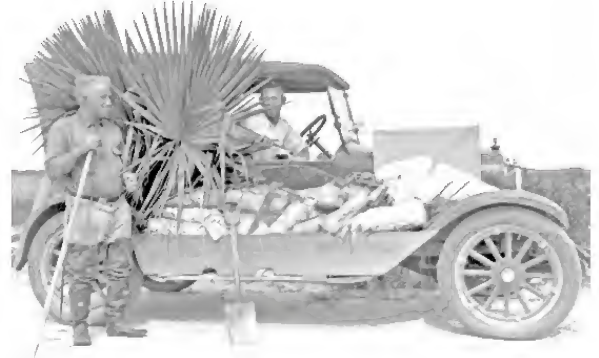
Kitchen-middens of various sizes, as well as aboriginal village sites, were found along all the creeks that empty into the coastwise lagoons. It has been said that " history repeats itself " and these old village sites proved it, for in a number of cases the motor tourists had selected these same aboriginal village-sites for camping places in their travels up and down the coast. (p.9)

We used the Dixie Highway as a detour and met the King's Road where it runs into the Dixie Highway near Ocean City (now Flagler Beach)... Frosts rendered collecting rather a secondary occupation, so we hastened to cross the peninsula by the shortest route to Crystal River. There we made further studies of the flora of the shell mound – Gulf Breeze Island – at the mouth of Crystal River... We also secured a number of the roots of the aboriginal morning-glory (*Ipomoea macrorhiza?*) for growing and for museum specimens. These roots, doubtless one of the food plants of the aborigines, vary greatly in size. The largest one we secured weighed fifty-two pounds several months after it was taken from the ground. (pp. 15-16)

Near Clearwater we turned eastward to cross over to the lake region... We drove down the back-bone of the lake region, and from the tops of the ridges various lakes and groups of lakes passed in view... A study of the floristics of these myriad lakes is a fascinating problem awaiting attack... The aquatic vegetation is almost unknown; the possibilities of novelty among the aquatic flowerless plants is indicated by the discovery, a few years ago, of a new species of quillwort (*Isoetes*) in lakes at Riverland (located in Sumter Co.). (pp. 17-18)

We drove down the prairie to the head of Lake Okeechobee. There we beheld a rare sight – the lake basin brim full and even overflowing. This season was the first that the lake was full of water in nearly a decade. For several years past, on our exploring trips, we have been driving our car for miles over the former bottom of

the lake, often several miles from the old shore-line. Furthermore, we had witnessed the wanton destruction of the gigantic humus-deposit of the Okeechobee basin – perhaps the largest in North America – and its unique hammock formation primarily by FIRE! The destruction of these works of ages in less than a decade is one of the several major crimes in the Florida Commonwealth. These crimes may be summed up in the words: DRAINAGE; FIRE; DESTRUCTION OF NATURE'S MONUMENTS; DESTRUCTION OF ABORIGINAL MONUMENTS. DRAINAGE AND FIRE are fast turning the Florida peninsula back to the desert it was when last elevated above the sea! (pp. 19-20)



John Kunkel Small's "Weed Wagon" photographed in the Spring of 1927. (State Archives of Florida/Small)

**Taylor, J.C., Karthick, B., Kociolek, J.P., Wetzel, C.E. & Cocquyt, C. 2014. *Actinellopsis murphyi* gen. et spec. nov.: A New Small Celled Freshwater Diatom (Bacillariophyta, Eunotiales) from Zambia. *Phytotaxa* 178(2):128-137.**

A new genus of diatom, *Actinellopsis murphyi*, found in southern Africa, was named after Kevin Murphy, a retired researcher from the Institute of Biodiversity, Animal Health and Comparative Medicine, University of Glasgow, Scotland [and the University of Florida, Department of Botany; see Retirement of Note in the Winter 2014 issue of AQUAPHYTE. Ed.]. His research emphasized plant and freshwater ecology, especially the role of vegetation in the biodiversity support functioning of ecosystems. In the naming of the new diatom flora the specific epithet refers to Dr. Murphy, the project co-coordinator of the SAFRASS (Southern African River Assessment Scheme) project to honour his contributions to the extension of the knowledge of the Zambian fauna and flora.

In this paper Taylor et al. describe *Actinellopsis murphyi* gen. et spec. nov., a small heteropolar and dorsiventral diatom from a seep habitat in Zambia. The diatom was collected from detrital material in seep water that had its origin from the waterfall spray zone of Ntumbachushi Falls. (Excerpt from Taylor et al. 2014 *Phytotaxa* article) <http://www.researchgate.net/publication/265600895>

## FROM THE DATABASE

The APIRS database now contains almost 93,000 annotated citations to the aquatic and wetland plant literature and to the literature on aquatic and natural area invasive plant species in Florida. A small sample of recent additions to the APIRS collection is provided below. References cited include peer-reviewed research articles, government reports, books and book chapters, dissertations and theses, and gray literature such as abstracts from proceedings. To obtain full-text of citations, contact your nearest academic library or search online.

For a literature search from APIRS, contact Karen Brown at [kpbrown@ufl.edu](mailto:kpbrown@ufl.edu)

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It's not just 'for the birds' anymore; expanding locations and species at risk from avian vacuolar myelinopathy (AVM)  
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Experimental tests of priority effects and light availability on relative performance of *Myriophyllum spicatum* and *Elodea nuttallii* propagules in artificial stream channels  
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Management options of invasive *Elodea nuttallii* and *Elodea canadensis*  
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## Mary's Look Back at APIRS

By Mary Langeland, Science Reader, Retired

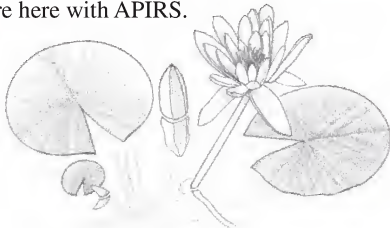
When I began working for the Aquatic Plant Information Retrieval System (APIRS) in the late 1980s, the focus was on compiling a collection of published research and literature on aquatic weed control, particularly water hyacinths and hydrilla. The end users in the early years were field operations personnel in the United States and in developing countries lacking the research capabilities available in the US.

...but it is also a museum, a time capsule of the field of aquatic plant management, field operations, and research.

From journal articles to US Army Corps of Engineer reports to monographs, the collection of literature began. Over the past 27 years, technological developments have increased the availability of information in many ways; but the value of APIRS remains in the collected literature that is not widely available online (field notes, letters, unpublished reports, etc.) gleaned from donated collections that had been stored in musty filing cabinets and cardboard boxes tied with string, papers clipped together by rusty paperclips or bound in two-hole binders, stained with coffee-cup rings, dog-eared from use and often with handwritten notes in the margins and some interesting doodling. In addition, APIRS has many thousands of citations on all aspects of aquatic plants and their management gleaned from several hundred sources, all in one place.

APIRS and the Information Office, as the physical location of the collection at the Center for Aquatic and Invasive Plants research facility, is referred to by the staff as a repository, but it is also a museum, a time capsule of the field of aquatic plant management, field operations, and research.

**Editor's note:** Long-time science reader/cataloger Mary Langeland retired effective October 1st, 2015 after more than 27 years with the CAIP Information Office and APIRS. Her expertise, knowledge and diligence, not to mention her professional support, collegiality, and supremely positive outlook, will be sorely missed. Ms. Lisa Olsen has been hired to fill this part-time position and is learning the numerous plant species names and our in-house cataloging system. Mary has volunteered to share her methods with Lisa—methods devised and adapted over her long and productive tenure here with APIRS.



## Graduate Students

Afsari Banu

Afsari is working on her Master of Science degree with Dr. Stephen Enloe. She previously attended the University of Agricultural Sciences, Bangalore, India where she received her M.Sc. in agronomy. Her master's thesis research was in weed science: "Evaluation of herbicides in transplanted Finger millet (*Eleusine coracana* Gaertn.)." Afsari is currently working on a project with Dr. Enloe: Controlling the *Ludwigia uruguayensis* complex in Florida: morphological, cytological and genetic tools to identify invasive taxa and variability in herbicide sensitivity.

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Cody Lastinger

Cody is from Lakeland, Florida, where he attended Florida Southern College. He received a Bachelor of Science degree in citrus production. He began his master's program in 2013 with Dr. Brent Sellers in the UF/IFAS Agronomy Department. His research project was on limpgrass (*Hemarthria altissima*) tolerance to herbicide applications. He graduated in August 2015. He began his Ph.D. program here at UF in August 2015 with Dr. Stephen Enloe, working on Brazilian pepper tree (*Schinus terebinthifolius*) control in Florida's mangrove communities.

clastinger@ufl.edu

Joshua Wood

Joshua received his bachelor's degree in environmental studies and biology from Manchester University in northern Indiana. He came to love aquatics during an internship at Manchester, where the effects of agricultural runoff on water quality and fish communities was monitored. He was also a part of removing two dams on the Eel River—the only dams to have been removed in Indiana. After his undergraduate work, Joshua and his wife moved to Gainesville. He is currently working on his master's degree with Dr. Mike Netherland, on the "Growth, Spread, and Management of Monoecious Hydrilla."

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Jon Gosselin

Jon Gosselin is a second-year graduate assistant from Bedford, New Hampshire, and is pursuing a Master of Science degree in the Agronomy department under Dr. Bill Haller here at UF. Jon was a Marine Science Technician in the U.S. Coast Guard from 2007 to 2015 and graduated from the University of New Hampshire in 2012 with a Bachelor of Science degree in environmental and resource economics. His research is focused on the growth and biology of Illinois pondweed (*Potamogeton illinoensis*) and he plans to graduate in Fall 2016.

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## UF/IFAS Entomology and Nematology Department and UF/IFAS Florida LAKEWATCH Evaluating Hydrilla Integrated Management Techniques

by Emma N.I. Weeks, Jennifer L. Gillett-Kaufman,  
James P. Cuda and Mark V. Hoyer

Emma Weeks, Jennifer Gillett-Kaufman and Jim Cuda of UF/IFAS Entomology and Nematology Department and Mark Hoyer of UF/IFAS Florida LAKEWATCH recently received funding from the United States Department of Agriculture (USDA) to work together on a new project. This project, which also includes Mark Jackson of the National Center for Agricultural Utilization Research (USDA-ARS, Illinois), will build upon the Research and Extension efforts that were implemented by the UF/IFAS Hydrilla IPM RAMP\* team.

Research at UF/IFAS is ongoing to evaluate novel and sustainable management tactics for hydrilla and to help develop integrated management plans for this invasive aquatic weed that has become resistant to several herbicides. The previous grant-funded project identified hydrilla management tools that were effective and demonstrated that tools could be combined to further improve hydrilla control. These tools included the hydrilla tip-mining midge, a plant-pathogenic fungus and the herbicide imazamox. The current project will build on these results through the completion of field-based experiments with the tools applied in different combinations as well as all three tools applied together.

Limnocorrals were installed in three ponds at the UF/IFAS Center for Aquatic and Invasive Plants. Each limnocorral is a floating tube that is open at the bottom and placed over the substrate containing growing hydrilla. Four limnocorrals were placed in each of the three ponds, allowing four treatments to be replicated three times. Over a period of one year, all possible combinations of the three tools described above will be tested to determine the most effective combination for use in hydrilla management. The experiments will be repeated in 2016 for consistency and results will be disseminated in 2017.

We acknowledge our funding currently provided by the U.S. Department of Agriculture (USDA), National Institute of Food and Agriculture (NIFA), Crop Protection and Pest Management Program (Grant 2014-70006-22517) and previously provided by the USDA NIFA.

\*Risk Avoidance and Mitigation Program (RAMP Grant 2010-51100-21653).

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*Adriana Mitchell and Jim Cuda collect measurements of hydrilla growing in a limnocorral. Data are being recorded by Emma Weeks on the bank. To measure the impact of the management tools on hydrilla, surface area coverage measurements are taken as well as depth of the hydrilla mass from the surface. At the end of the experiment, the mass of hydrilla will be collected and dried to calculate dry weight of hydrilla remaining after treatment.*



*Adriana Mitchell and Jim Cuda sample hydrilla tips from a limnocorral. To measure establishment of biological control agents and hydrilla damage, apical meristem samples are collected as a baseline, halfway through and at the conclusion of the experiment.*



*Ludwigia hexapetala* infestation on Lake Tohopekaliga – see page 3

Photo by Jeff Schardt

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## AQUAPHYTE

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**AQUAPHYTE** is sent to managers, researchers and agencies in numerous countries around the world. Comments, announcements, news items and other information relevant to aquatic and invasive plant research are solicited.

Inclusion in **AQUAPHYTE** does not constitute endorsement, nor does exclusion represent criticism, of any item, organization, individual, or institution by the University of Florida.

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